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EXAMINER

FETZNER, TIFFANY A

ART UNIT

PAPER NUMBER

2862

DATE MAILED: 11/19/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/535,241

Applicant(s)

Tsuda, Munetaka

Examiner

Tiffany Fetzner

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on Sep 11, 2002

2a) This action is FINAL. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-31 is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-31 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some* c) None of:

1. Certified copies of the priority documents have been received.

2. Certified copies of the priority documents have been received in Application No. _____.

3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) The translation of the foreign language provisional application has been received.

15) Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) Notice of References Cited (PTO-892)

4) Interview Summary (PTO-413) Paper No(s). _____

2) Notice of Draftsperson's Patent Drawing Review (PTO-948)

5) Notice of Informal Patent Application (PTO-152)

3) Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____

6) Other: _____

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DETAILED Non-final ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file. The certified English translation has been received.

Claim Rejections - 35 USC § 102

2. The rejection of **Claims 1-13** under **35 U.S.C. 102(b)** as anticipated by **Ishihara et al.**, US patent 5,378,987 issued January third 1995; filed March 11th 1993; are **rescinded** in view of applicant's arguments in the March 4th 2002 response.
3. The rejection of **Claims 1-13** under **35 U.S.C. 102(e)** as anticipated by **Watkins et al.**, US patent 6,252,405 B1 issued June 26th 2001 filed November 15th 1999; are **rescinded** in view of applicant's certified priority English translation received August 23rd 2002, and the September 1st 2002 Amendment response.
4. However new art which addresses applicant's arguments, and amended claims has been found.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. The rejection of **Claims 1-13** under 35 U.S.C. 103(a) as being unpatentable over **Ishihara et al.**, US patent 5,378,987 issued January third 1995; filed March 11th 1993 are rescinded in view of applicant's arguments in the March 4th 2002 response.

9. **Claims 1-31** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Yamaguchi et al.**, US patent 4,663,592 issued May 5th 1987 in view of **Warner** UK patent GB 2 219 406 A Published 6 December 1989.

10. With respect to **Claim 1**, **Yamaguchi et al.**, teaches and shows a magnetic resonance imaging apparatus comprising: a static magnetic field generating unit (i.e. a magnetic coils 1) that generate a static magnetic field of a constant magnetic field intensity;" [See col. 1 lines 13-28, col. 1 line 64 through col. 2 col. 2 line 21, col. 4 line 29 through col. 5 line 50, Figures 1 and 5] "a high-frequency magnetic field generating unit; [See Figure 5 RF oscillator component 35] **Yamaguchi et al.**, teaches, suggests and shows "a detecting unit" (i.e. the RF receiver coil taught in col. 2 lines 15-21) "that detects magnetic resonance signals generated from an object to be examined"[See Figures 1 through 5, col. 2 lines 15-21]. **Yamaguchi et al.**, teaches, suggests and shows "a display unit that displays a result of the detection", [See Figure 5, col. 4 lines 29-62]

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“wherein the magnetic resonance imaging apparatus further comprises: a magnetic field correcting unit” (i.e. the adder/subtractor A/S circuit 17 of Figure 1, along with current sources 19, 20, and the magnetic coils 1,) “that generates an additional magnetic field for making uniform a space distribution of the static magnetic field;” [See Figures 1, 5, col. 2 lines 33-41, col. 2 line 42 through col. 3 line 39. Specifically, the teaching of col. 3 lines 33-39 suggests that when variations in the static magnetic field H_0 occur due to temperature variation the above described embodiment will react and cause the magnetic fields to be applied, at a constant intensity, by controlling the value of the current. This teaching suggests that at least one additional magnetic field is applied to keep the static magnetic field H_0 constant.] The ability to generate an additional controlling magnetic field, as a result to a change in temperature detected by a temperature sensor to keep the static magnetic field constant is also taught by **Warner**. [See **Warner** page 5 lines 5-13, page 5 line 33 through page 6 line 10; page 6 line 35 through page 7 line 23; and claims 13, 15, 17 and 18 on pages 10 and 11 of the **Warner** reference.]

11. Additionally, **Yamaguchi et al.**, teaches, suggests and shows “a temperature detecting unit that detects a temperature of the static magnetic field generating unit and/or surroundings thereof;” [See col. 3 lines 21-39, Figure 1] “a control unit” (i.e. the adder/subtractor A/S circuit 17 of Figure 1) “that controls the magnetic field correcting unit;” (i.e. the adder/subtractor A/S circuit 17 of Figure 1, along with current sources 19, 20, and the magnetic coils 1,) “based on the temperature detected by the temperature-detecting unit.” [See Figures 1, 5, col. 2 lines 33-41, col. 2 line 42 through col. 5 line 50.]

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12. **Yamaguchi et al.**, lacks teaching that the main magnet of a magnetic resonance imaging device also includes at least one gradient field coil/unit that generates a magnetic field strength gradient;” explicitly, however, it is well established that magnetic resonance systems inherently have at least “one gradient field coil for generating a gradient magnetic field”, because, in an MRI system there are intentionally applied time varying magnetic fields, (i.e. magnetic field gradients) which are well known and conventionally applied in one or more of the x, y, and z axis directions. The magnetic field gradients are produced conventionally by gradient coils, which are necessary to impose the magnetic fields which encode the phase, frequency, and / or slice, of the RF excitation pulses applied to the main, static, and substantially homogeneous and uniform B₀ magnetic field. In general, it is well known that the interaction of the excitation pulse, the static magnetic field, and the magnetic field gradients allow the magnetic resonance phenomenon to form an output image as a result of computer processing. Without the presence of the inherent magnetic gradients, which are conventionally applied on axes which are orthogonal to each other, and implicitly the means to produce them, (i.e. at least one gradient coil), magnetic resonance imaging would not result. Therefore, the examiner considers in inherent that the **Yamaguchi et al.**, has “at least one gradient coil for generating a gradient magnetic field”.

13. Additionally, **Warner** suggests the presence of “at least one gradient coil for generating a gradient magnetic field”. [See page 2 lines 13-28 where the ferromagnetic means is interpreted by the examiner as a main magnetic field means, and where the windings which cooperate with the ferromagnetic means, are broadly interpreted by the examiner as being representative of a gradient coil that may be arranged around the x, y, and z axes] **Warner** also teaches that the control means

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may control or maintain current in at least one said winding (i.e. a gradient coil) irrespective of at least one change in temperature, [See page 4 lines 24-30] The Warner reference can be combined with the teachings of Yamaguchi et al., because both apparatuses are specifically directed toward controlling the intensity of the static magnetic fields in an MRI system and effectively compensating for temperature changes, that can occur in an MRI system.

14. With respect to **New Claim 14**, this claim is just another version of **claim 1**, that specifies that the static magnetic field is homogeneous, therefore the same reasons for rejection, obviousness, and motivation to combine, that apply to **claim 1** also apply to **New claim 14** and need not be reiterated.

15. With respect to **New Claim 23**, this claim is another version of claim 1, with a few additional limitations, for the purpose of brevity only the rejections for the additional limitations are given below. Yamaguchi et al., teaches, suggests and shows “said static magnetic field generating unit comprising” at least “a pair of superconducting coils and a pair of cryostats each accommodating one of said pair of superconducting coils;” [See Figure 1] a supporting means (i.e. frame component 3) for supporting said pair of cryostats as being apart so as to form an inspection space for an object to be examined” [See Figure 1] The same reasons for rejection, obviousness, and motivation to combine that apply to **claims 1, 4, 8, 14, 17, 21** also apply to **claim 23** and need not be reiterated.

16. With respect to **New Claim 30**, this claim is another version of claim 23, with an additional limitation of “correcting non-uniformity of said static magnetic field being caused by deformation of said supporting means due to the temperature change of said static magnetic field

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generating unit and/or surrounding space of it;" **Yamaguchi et al.**, teaches, suggests and shows this limitation. [See the abstract, col. 1 line 64 through col. 2 line 32, col. 3 line 21 through col. 3 line 54] The same reasons for rejection, obviousness, and motivation to combine that apply to **claims 1, 4, 8, 14, 17, 21, 23** also apply to **claim 30** and need not be reiterated.

17. With respect to **Claim 2**, and corresponding **New claims 15, 24** which depend from **claims 14 and 23** respectively, **Yamaguchi et al.**, teaches and suggests "the control unit has a temperature setting unit that sets a temperature detected by the temperature-detecting unit." [See col. L line 64 through col. 5 line 50, Figures 1 through 5.] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 14, 23** also apply to **claims 2, 15, and 24** and need not be reiterated.

18. With respect to **Claim 3**, and corresponding **New claims 16, 25** which depend from **claims 14 and 23** respectively, **Yamaguchi et al.**, teaches and suggests that "the temperature detecting unit detects temperatures of at least two positions." [See col 2 lines 26-30, col. 1 line 64 through col. 5 line 50 in general.] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 14, 23** also apply to **claims 3, 16, and 25** and need not be reiterated.

19. With respect to **Claim 4**, and corresponding **New claims 17, 26** which depend from **claims 14 and 23** respectively, **Yamaguchi et al.**, lacks teaching directly that "the magnetic field correcting unit comprises a shim coil for generating an additional magnetic field and a shim power source that supplies a current to the shim coil, however **Yamaguchi et al.**, teaches that the temperature distortions are corrected by taking the temperatures of various parts, and taking

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various coefficients and reference voltages, and then adjusting the current source, (i.e. power source) to produce a constant magnetic field intensity of the subject, or adjusting the RF current applied to an RF coil, or mathematically adjusting the results. [See col. 5 lines 23-33] The ability to take the temperatures of various parts, and taking various coefficients and reference voltages, and then adjusting the current source, (i.e. power source) to produce a constant magnetic field intensity of the subject, suggests, that an additional correctional magnetic field may be implied on the main static field to maintain the static field at a constant value. The **Yamaguchi et al.**, reference lacks a direct teaching on this point, however the teachings of **Warner** do teach and suggest that “at least one temperature sensor is used to detect a temperature change in at least a portion of the static magnetic field ferromagnetic means, and that feedback circuitry then changes at least one magnetic control winding (i.e. the examiner considers the control windings of **Warner** to be effectively a magnetic shim coil) to provide at least one controlling magnetic field.”

[See **Warner** page 5 lines 5-13] The examiner considers the “controlling magnetic field” to be applicant’s “additional magnetic field”. Additionally, **Warner** teaches that the control winding(s) may be energized by any suitable power supply, [See page 5 lines 33-34] therefore the teachings of **Warner** also suggest “a shim power source that supplies a current to the shim coil”, because there is a power source that is providing power to the control coil winding, (i.e. the shim coil).

The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 14, 23** also apply to **claims 4, 17 and 26** and need not be reiterated..

20. With respect to **Amended Claim 5**, and corresponding **New claims 18, 27** which depend from **claims 14 and 23** respectively, **Yamaguchi et al.**, teaches and / or suggests that “the control

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unit (i.e. the adder/subtractor A/S circuit 17 of Figure 1) comprises a voltage generating unit that generates a voltage corresponding to a non uniformity component of the magnetic field at the temperature detected by the temperature detecting unit, a voltage/current converter that converts the voltage output by the voltage generating unit to current, and a supplying unit that supplies to the magnetic field correcting unit the current generated from the voltage/current converter.” [See col. 1 line 64 through col. 5 line 50] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 14, 23** also apply to **claims 5, 18, 27**.

21. With respect to **Claim 7**, and corresponding **New claims 20, 29** which depend from **claims 14 and 23** respectively, **Yamaguchi et al.**, shows and suggests that “the temperature detecting unit is disposed near the static magnetic field generating unit and/or in a room where the static magnetic field generating unit is placed.” [See Figures 1 through 5, which suggests that all of the components are in close proximity to one another, or in a single defined area, (i.e. a room).] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 14, 23** also apply to **claims 7, 20, 29**.

22. With respect to **Amended Claim 8**, and corresponding **New claim 21** which depends from **claim 14**, these claims are the corresponding method claims of apparatus **claims 1, and 14** **Yamaguchi et al.**, teaches and suggests “A method of maintaining a static magnetic field generated by a static magnetic field generating unit uniform in a magnetic resonance imaging apparatus, by generating an additional magnetic field, [See col. 3 lines 20-39] the method comprising the steps of: calculating a temperature dependence of a non-uniform component of a space distribution of the static magnetic field.” [See col. 1 line 6 through col. 5 line 50,

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specifically col. 2 line 52 through col. 3 line 14] **Yamaguchi et al.**, also teaches and suggests “detecting a temperature of the static magnetic field generating unit; and/or surroundings thereof” [See col. 3 lines 21-61] “and calculating/generating a strength of the additional magnetic field” [See col. 2 line 62 through col. 5 line 43] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 4, 14, 17** also apply to **claims 8, 21**.

23. With respect to **Claims 6**, and corresponding **New claims 19, 28** which depend from **claims 14** and **23** respectively, and corresponding **claim 12** which depends from **claim 8**, **Yamaguchi et al.**, lacks teaching that “the magnetic field correcting unit generates at least one additional magnetic field of linear term of y, quadratic term of z and quartic term of z, where z is the direction of the static magnetic field and y is one direction orthogonal to z.” however, the controlling winding of **Warner**, which provides at least one controlling magnetic field, illustrated in Figures 1 and 2 suggests this limitation. [See Figure 1, where the x and y direction are orthogonal to the z-axis; and page. 5 lines 5-13; page 6 line 19 through page 7 line 23]. The examiner also notes that within the MRI / NMR art the direction of the static magnetic field is conventionally designated to be z, while the two remaining orthogonal directions are conventionally designated x and y; with x being the primary orthogonal plane in horizontal configurations, and y the primary orthogonal plane in vertical magnet, or open magnet situations. Given the orientation of the magnet in Figure 2, the interpretation that the direction of the magnetic field produced by correction coils 166, as “y” is conventional, inherent, and proper. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 4, 8, 14, 17, 21, 23**, also apply to **claims 6, 12, 19, 28**.

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24. With respect to **Claim 9**, **Yamaguchi et al.**, lacks teaching that the “steps from the temperature detection to the generation of the additional magnetic field are conducted at all times”, However, **Warner**, suggests that “steps from the temperature detection to the generation of the additional magnetic field are conducted at all times”, because **Warner**, teaches that “the total magnetic field in the region may be maintained substantially constant ... even though the temperature of the environment may change substantially.” [See page 5 line 5 through page 6 line 10, and the entire reference in general]. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 4 and 8** also apply to **claim 9**.

25. With respect to **Claim 10**, **Yamaguchi et al.**, suggests that the “steps from the temperature detection to the generation of the additional magnetic field are conducted at predetermined time intervals”, because **Yamaguchi et al.**, performs corrections, when the average temperature of the coils rises 1 degree Celsius. [See col. 2 line 52 through col. 3 line 14;] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 4, 8** also apply to **claim 10**.

26. With respect to **Claim 11**, **Yamaguchi et al.**, teaches and suggests “measuring NMR signals generated from an object to be examined; [See col. 4 lines 29 through col. 5 line 50] “calculating a magnetic field error component attributable to the object using the measured NMR signals” [See col. 2 lines 52 through col. 3 line 61]; and “calculating a strength of the additional magnetic field based on the error component attributable to the object” [See col. 3 lines 20-39; col. 5 lines 23-43]; **Yamaguchi et al.**, suggests “generating an additional magnetic field having an intensity equal to that of the sum of that obtained based on the detected temperature and the

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temperature dependence and that calculated based on the error component.” [See col. 1 line 41 through col. 5 line 50] Additionally, **Warner** teaches this limitation. [See page 5 lines 5-13; page 5 line 33 through page 6 line 10; page 6 line 35 through page 7 line 23; and claims 13, 15, 17 and 18 on pages 10 and 11 of the **Warner** reference. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 4, and 8** also apply to **claim 11**.

27. With respect to **Claim 13**, **Yamaguchi et al.**, teaches, shows and suggests “A magnetic resonance imaging apparatus comprising: a static magnetic field generating means that generates a static magnetic field of a constant magnetic field intensity” [See Figure 1 main magnet(s) 1], and a uniformity correcting means (i.e. temperature sensors 11-15, 16, and add/subtract circuit 17) “that detects a temperature change affecting the uniformity of the magnetic field generated by the static magnetic field generating means” [See col. 1 line 64 through col. 5 line 50] **Yamaguchi et al.**, also teaches generating a magnetic field for canceling a change of the magnetic field intensity due to a temperature change based on the detected temperature change.” [See col. 2 line 52 through col. 5 line 50]. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 1, 4, and 8**, also apply to **claim 13**.

28. With respect to **New Claim 22**, **Yamaguchi et al.**, teaches, suggests and shows “A magnetic resonance imaging apparatus comprising: a static magnetic field generating means for generating a homogeneous static magnetic field in an inspection space; [See Figure 1] “and an uniformity correcting means for detecting temperature change affecting the uniformity of the static magnetic field generated by the static magnetic field generating means” [See Figure 1, temperature detection sensors 11-15, 16, and add/subtractor circuit 17] “for generating an

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additional static magnetic field for canceling non-uniformity of the static magnetic field based on the detected temperature change.” [See abstract, col. 1 line 41 through col. 5 line 50] Additionally **Warner** teaches these limitations. [See Figures 1 through 3; page 1 line 2 through page 11 line 30] The examiner notes that specifics concerning these limitations have already been given earlier in this rejection, that need not be reiterated again. The same reasons for rejection, obviousness, and motivation to combine that apply to **claims 1, 4, 8, 14, 17, 21** also apply to **claim 22**.

29. With respect to **New Claim 31**, which in alternative only form depends from either claim 1, 13, 14, 23 or 30; **Yamaguchi et al.**, teaches, suggests and shows a “means for calculating a temperature dependence of non-uniformity of the static magnetic field in the inspection space, said nonuniformity distribution of the static magnetic field being caused by temperature change of the static magnetic field generating unit and/or surroundings thereof; means for holding a control data for correcting the non-uniformity of the static magnetic filed corresponding to the temperature; and means for outputting the control data being selected from said control data holding means based on the detected temperature into said control unit. [See Figures 1 through 5; abstract, col. 1 line 64 through col. 5 line 50.] Additionally **Warner** teaches these limitations. [See Figures 1 through 3; page 1 line 2 through page 11 line 30] The examiner notes that specifics concerning these limitations have already been given earlier in this rejection, that need not be reiterated again. The same reasons for rejection, obviousness, and motivation to combine that apply to **claims 1, 4, 8, 14, 17, 21, 23** also apply to **claim 30** and need not be reiterated.

30. Prior Art of Record

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31. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- A) Ishihara et al., US patent 6,194,899 B1 issued February 27th 2001; filed February 17th 1999.
- B) Ishihara et al., US patent 5,378,987 issued January third 1995; filed March 11th 1993;
- C) Watkins et al., US patent 6,252,405 B1 issued June 26th 2001 filed November 15th 1999; This reference is not prior art due to applicant's certified English priority translation.

Conclusion

32. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is (703) 305-0430. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

33. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Lefkowitz, can be reached on (703) 305-4816. The fax phone number for the organization where this application or proceeding is assigned is (703)305-3432 .

34. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0956.


TAF

November 14, 2002


EDWARD LEFKOWITZ
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800